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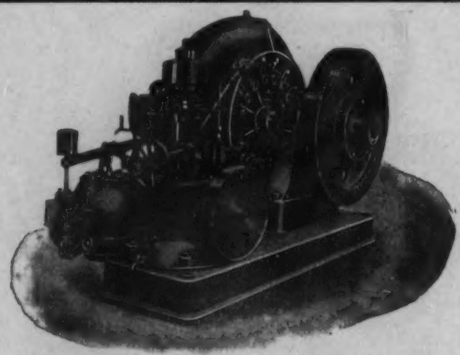

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STORAGE SYSTEM OF SOUTH YUBA WATER COMPANY

BY H. M. COOPER [1]

The denudation of the forests of California since its settlement in 1849, more particularly in the middle central section of the state, has made the conservation of water a difficult problem. The United States government, realizing the necessity for the preservation of the forests, primarily for water conservation, has, within the last decade, established stringent regulations, and has, at certain vital points of the state, established forest reserves for the purpose of protecting the remaining trees, and aiding thereby the protection of the watersheds, that, in future years, will be invaluable to the industries of the Pacific slope. Within the northeasterly regions of the South Yuba system little or no timber ever grew, the granite walls of the Sierra Nevadas affording little foothold for foliage.

The high altitudes precipitate large quantities of snow during the winter season and the run-offs from the watersheds controlled by the South Yuba Water Company, following the average winter, more than provide for the needs of the company in its supply of water for mining, irrigation and domestic purposes. The watersheds, particularly of Lake Fordyce, Lake Spaulding, Meadow Lake, and the chain of lakes known as Felley, Culberton, etc., would provide, with additional storage, more than sufficient water to supply not only the needs of the South Yuba water system as at present developed, but also the entire Sacramento and San Joaquin valleys with water for municipal purposes, and there would then be a sufficient quantity left to supply the entire city and county of San Francisco.

Lake Alta, in Placer County.

Many opportunities are presented for the utilization of the waters stored at the higher altitudes for the generation of electric power, particularly in the canyons of the Yuba river, and on the South Fork and Middle Fork are splendid reservoir sites as yet undeveloped. The dams at Lake Fordyce and Lake Spaulding could be materially increased in height to afford additional storage.

The following is a brief description of the present storage capacities possessed by the South Yuba Water Company generally, giving the character of dam,

[1] Superintendent Pacific Gas and Electric Company's Auburn Water District.

structures, and capacities of present available water.

Few people aside from those directly interested realize the importance of an efficient water storage, and the great cost and many details necessary to conserve a part of the winter floods for use during the the dry or irrigating season.

Lakes of Lake Valley.

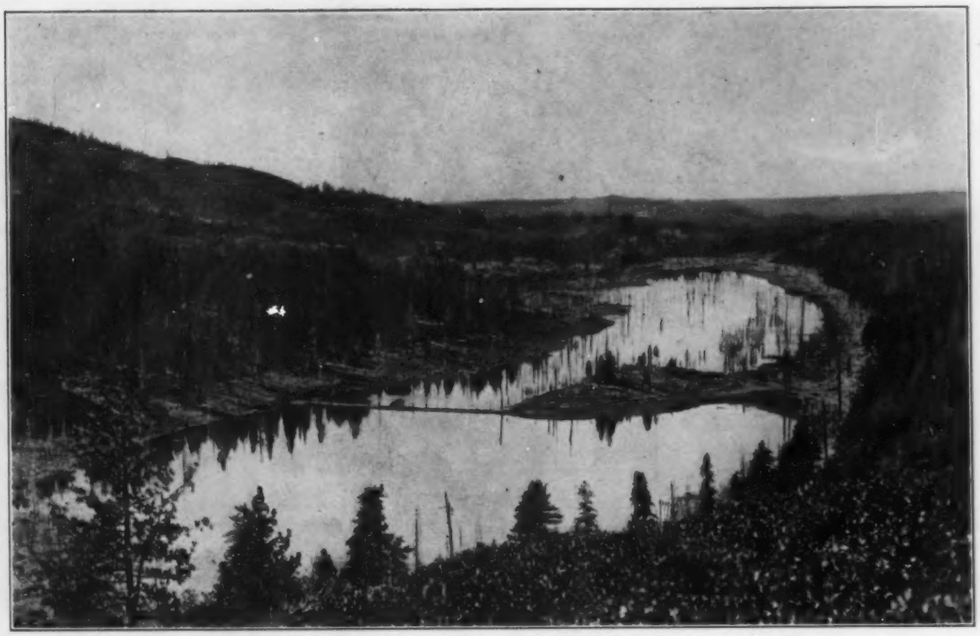
The South Yuba Water Company diverts, from storage alone, into the canals about 1,000,000 miner's inches; this is the amount of water in reserve and is not drawn upon until all the overflow of surplus water has been consumed. Last season's storage was drawn upon July 20th, and with reasonable care on the part of consumers the amount was sufficient to keep up the supply during the dry season.

As early as 1850, ditches were constructed to supply water for miners using "long Toms," although it was not long before the system of hydraulic mining was introduced, necessitating more ditches and an increased water supply; later all hydraulic mining was enjoined, which decreased the demand for water to such a degree that improvements in the system came to a standstill. Within a few years the consumption began to increase, due to the rapid strides in electricity requiring hydroelectric generating stations, and the development of deep-mining using water to operate pumping plants, hoists, etc., and the planting of extensive orchards which depend entirely on storage water for irrigation, until today the water requirements are much greater than ever before.

To meet the almost continuous growing demands, a series of lakes has been constructed for storage purposes. At present this system comprises 23 lakes and reservoirs, which have a combined holding capacity of 48,700 acre feet, or 1,227,000 miner's inches, equivalent to 2,122,022,000 cubic feet, or 15,915,165,000 gallons.

These figures represent the total amount of stored water. Absorption, which is the combined action of evaporation and percolation, represents the loss of a large amount of water. However, the loss from deep lakes is much less than from shallow ones having the same surface area, where climate and altitude are identical. The evaporation is least when the air is quiet, the temperature of water low, and the atmosphere moist. When brisk winds are blowing which disturb the water surface, on a hot day, the evaporation is greatest, as the unsaturated air readily absorbs the vapors arising from the disturbed water. Naturally, the deeper the lake the less water is exposed to the sun. The whole mass of water is held at a lower temperature than otherwise. The cool water tends to condense the moisture from the warm air, which is a gain rather than a loss as many would suppose. In a shallow lake, with the temperature of the water higher, the evaporation is greater; therefore, when conditions permit, it is desirable to draw off the small

Downstream Face of Fordyce Dam.



Holding 1,725,300,000 Gallons.

and shallow lakes during the early part of the season, thereby preventing a considerable loss due to evaporation. The deep water lakes are held intact until the latter end of the season.

The largest and most important storage in the South Yuba system is Lake Fordyce, lying in portions of sections 25, 26, 34, 35 and 36, T. 18 N., R. 13 E., with a small part in section 3, T 17 N., R. 13 E., and covering altogether a flooded area of 510 acres, with a capacity sufficient to furnish a flow of about 400,000 miner's inches in twenty-four hours. The dam was built in 1871 and 1872, and it is composed of solid masonry, 75 feet high and 645 feet long. It has a catchment area of 30.15 square miles, a maximum capacity of 875,000,000 cubic feet, which is equivalent to 20,090 acre-feet, or a flow of 404,166 miner's inches in 24 hours. The elevation at the crest of the dam is 6,294 feet; at the bottom outlet, 6,225 feet.

The dam is of earth and rock fiill, faced with 3-inch by 8-inch plank on the inner side, and has a maximum height of 92 feet and a length of crest of 800 feet; the width of the crest is 5 feet; and the maximum width of the base is 139 feet; the inner slope is 1 to 1, and the other slope ½ to 1 and ¼ to 1.

The spillway is 99 feet wide by 3 fee, 7 inches deep, with checking planks bringing high-water to the crest of the dam.

The outlet pipe is 36 inches in diameter, of ¼ inch concrete. The flow is controlled by a slide gate of cast iron, 3 feet 6 inches by 5 feet 2¼ inches, placed at the upper end of the pipe, and operated from the crest of the dam by mechanism and by stem on the face of the dam. There is also a 30-inch gate-valve at the lower end of the outlet pipe.

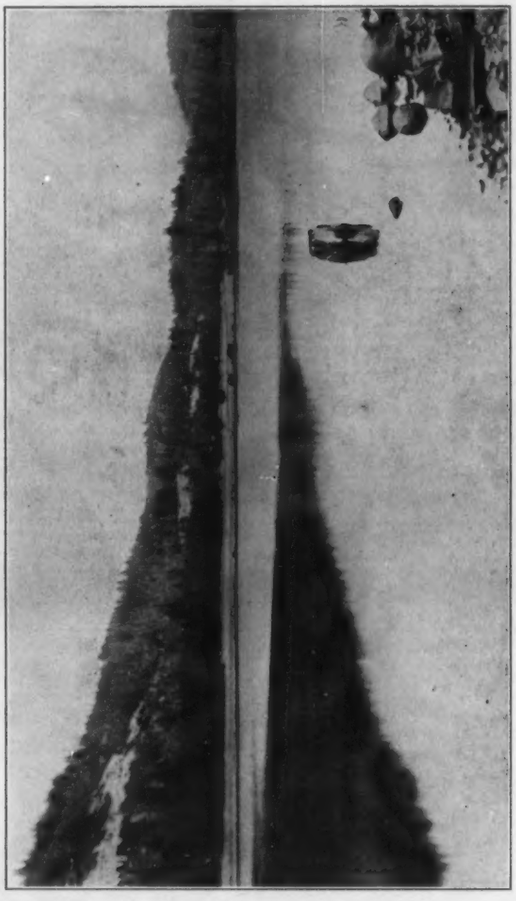
The work on Lake Fordyce was started by the South Yuba Water Company in 1875. During the years 1874 and 1875 a large force of men was employed, and the dam was completed to a height of 55 feet.

A masonry wall of two tiers of rock was built to form the down stream face. Then the body of the dam was built up of loose rock, hand placed. The inner slope of the dam was then formed by a layer of rock and earth, and was faced with boards. In 1881 another tier, 16 feet high and 5 feet wide at the crest, was added, bringing the dam to its present height. It is estimated that the run-off from Lake Fordyce is sufficient to fill the reservoir at least twice during the driest year.

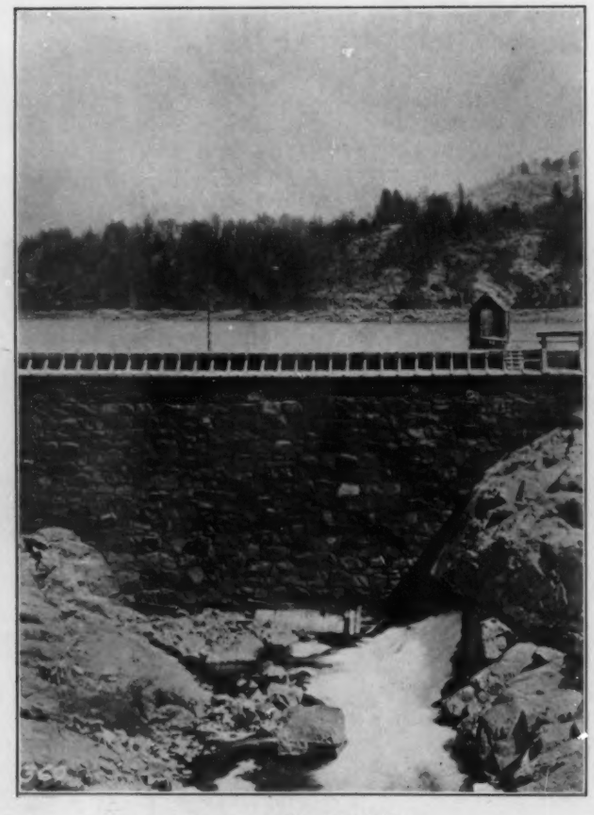
With the exception of Lake Valley, the whole of this water comes from the water-shed feeding the South Yuba river, and with the exception of Bear Valley Lake and Lake Valley, the storage water is controlled by Lake Spaulding, where it is drawn from the outlet gate into the river to be again diverted to the main canal leading to the lower country. At Bear Valley a certain portion of the water is turned

The Dam at Lake Fordyce.

Water Leaving Alta Power House.



Bear Valley Lake.



Dam at Lake Spaulding.

out of the main canal into the lake, which is used for a combined storage and regulator, whence it is drawn into the Boardman ditch, which in turn connects with the Lake Valley water at the head of the Alta Power House pipe-line. After leaving the water wheels at the power house the water is again taken up, and it then flows as far west as Rockville, Placer county. The main canal, after leaving Bear Valley, continues its course as far west as Grass Valley, Nevada county.

The following list gives a detailed account of each lake:

Name of Lake.	Elevation at Crest of Dam.	Flow Capacity Miner's Ins.	Water Depth Ft.	Ins.
Sterling	6700	33,220	19	
Spaulding		117,600	51	
Lake Valley.....	5846	106,500	55	
White Rock.....	7752	13,500	9	
Meadow	7249	92,620	30	
Bear Valley	4365	6,500	24	
Van Norden.....	6770	106,500	25	4
Upper Peak.....		33,200	37	
Lower Peak.....		10,600	26	
Kid Peak.....		32,300	28	6
Lost River.....		5,000	7	
Blue		23,900	24	4
Rucker		9,600	15	
Fuller		19,400	27	
Upper and Lower Rock		26,000		
Upper Feeley		6,000	11	9
Upper Middle and Lower Lindsay.				
Culberson.				

THE ORCHARD-IRRIGATING SYSTEM OF THE SOUTH YUBA WATER COMPANY.

BY W. E. LININGER.[1]

The irrigation system of the South Yuba Water Company is largely the result of the passing of the mining industry.

The gradual working out of the placer mines about that time rendered it necessary for many people to seek other means of livelihood and, the cities on the Comstock lode and other mining towns in the state of Nevada affording good markets, a large number turned their attention to horticulture. The demand thus created for water soon became greater than the

Three Square Miles of Orchard Irrigated near Loomis.

An Irrigated Orange Orchard Upon Undulating Hills near Loomis.

In the early 50's the Bear River Ditch Company constructed a canal about 50 miles in length from a point on Bear river about three miles above Colfax to a point near Newcastle, and from that point constructed several smaller distributing ditches for the purpose of supplying water for mining purposes. The control of this company passed through several different stages before, in 1876, it was purchased by E. Birdsall.

Up to that time irrigating had not been considered a factor in the water business. A few of the people, however, irrigated small garden patches and a few

Birdsall company was able to supply during July, August, and September, as it had no storage and was entirely dependent upon the natural flow in Bear river, which was very low during these dry months.

The South Yuba Water Company, which up to that time had been operating only in Nevada county, and, prior to Judge Sawyer's decision in the debris cases, had derived a large part of its income from the sale of water to the hydraulic mines, had built or acquired a number of storage reservoirs. Among them were Lakes Fordyce, Meadow, Sterling, Cascade, and others, to provide an ample water supply during the

Flume and Pipes near Gold Run.

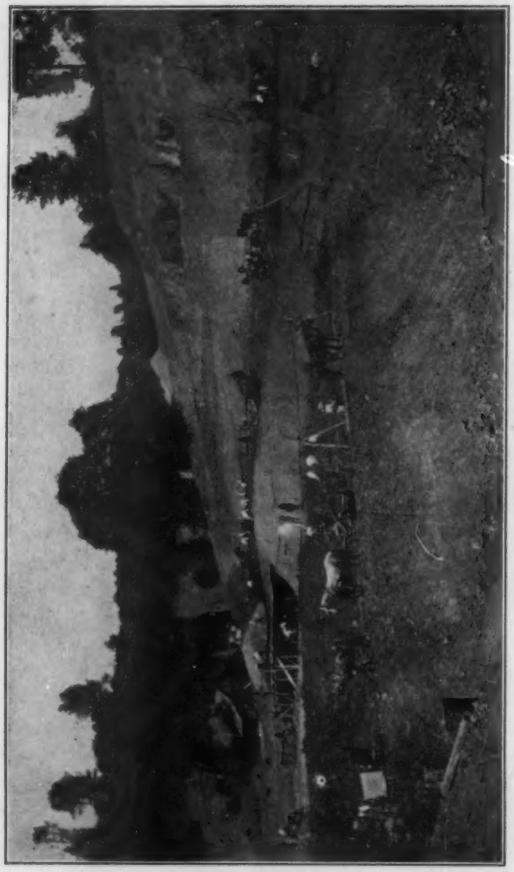
Section of South Yuba Canal.

trees and vines, the product of which was marketed principally among the miners in adjacent towns.

Those pioneers in the fruit business demonstrated two facts: first, that the climate was ideal, and second, that with water for irrigation deciduous fruits could be grown to perfection and at a profit.

which there was no sale, and also cut off the greater part of the company's revenue. During the last few years of the Birdsall ownership of the Bear River ditch considerable quantities of water were therefore easily purchased by the Birdsall company from the South whole of the year. The effect of the Sawyer decision, closing nearly all the hydraulic mines, left the South Yuba company with a bountiful supply of water for

[1]Pacific Gas and Electric Company's Auburn Water District.



Lake Arthur Dam During Construction.

Lake Theodore in the Summertime.

Yuba county during the later months of the dry season.

This state of affairs did not prove satisfactory, and in the year 1890 the South Yuba company bought the Bear River ditch properties and began a systematic development of the irrigating system.

The constantly increasing demand for water, necessitating an increase in ditch capacity and storage, resulted in the reconstruction of the Boardman ditch from Bear Valley to Gold Run; thence in the building of a new system into the fruit district, a distance, by way of the ditch, of 16 miles; also in the building of Lake Spaulding and Lake Van Norden and the acquiring of the Towle water system, including Valley Lake. Now the company has in operation for use in the fruit district of Placer county about 265 miles of ditches, pipes, and flumes and a storage capacity of 1,036,000,000 cubic feet, by means of which it distributes to the growers about 1800 miner's inches of water each day of twenty-four hours from May 1st to September 1st. This water irrigates approximately 13,500 acres, the consumption being one inch for 5 to 10 acres and averaging about one-inch to 7½ acres. The annual product of this irrigated land amounts to about 2,500 carloads of 24,000 pounds each, 80 per cent of which is shipped east and north and sold in the fresh state, the balance being either sold for canning or dried. About one acre in three in the district covered by this system is now under cultivation.

The conditions are materially different from nearly, if not all, the other irrigation systems of California, in that the hilly nature of the ground to be irrigated and the distance the water has to be conveyed from the source of supply to the point of distribution renders flooding or the use of large heads impracticable and makes it necessary for each consumer to run a smaller head and use it continuously, shifting it from one part of the orchard to the other as occasion requires.

Taking into consideration the fact that any variation, at the source or along the line of ditch, by reason of leakage in pipes, flumes, or ditch, produces a proportionate variation at the ends of the distributing ditches, it is obvious that it requires the greatest watchfulness and care upon the part of the employees, from the greatest to the least, to the end that each consumer may receive his regular supply from May 1st to September 30th without wasting a considerable quantity of water in the process.

To overcome this, and also the variation caused from evaporation arising from differences in temperature, the company has from time to time constructed reservoirs at or near the lower ends of the distributing ditches to act as regulators. These, together with Lake Theodore on the Boardman ditch and Lake Arthur on the Fiddler-Green ditch enable them to give a very efficient service.

Only once since 1894, when the writer entered the employ of the company, has there been any serious interruption of service. That once was in August, 1905, when a break and slide in the bank of the Bear River ditch rendered it necessary to transport the material 13 miles and build 450 feet of flume, 5 feet wide and 5 feet deep. This was done and the water turned in again in ten days' time.

THE WATT-HOUR METER.

BY WM. M. SHEPARD AND ALLEN G. JONES.

(Continued.)

CHAPTER III.

THE INDUCTION METER.

At the present time the induction type of watt-hour meter is used almost exclusively where alternating currents are concerned, and as alternating current is much more extensively used for general lighting and power distribution than is direct current, there are considerably more induction meters being manufactured than there are of any other type.

Reasons for Its Extensive Use.

Some of the principle reasons for this almost exclusive use of the induction meter on alternating current circuits are as follows: The induction meter is more rugged in design, having no brushes, no commutator, or other moving contacts. The revolving element consists simply of the shaft and revolving disc, all windings being on the stationary element.

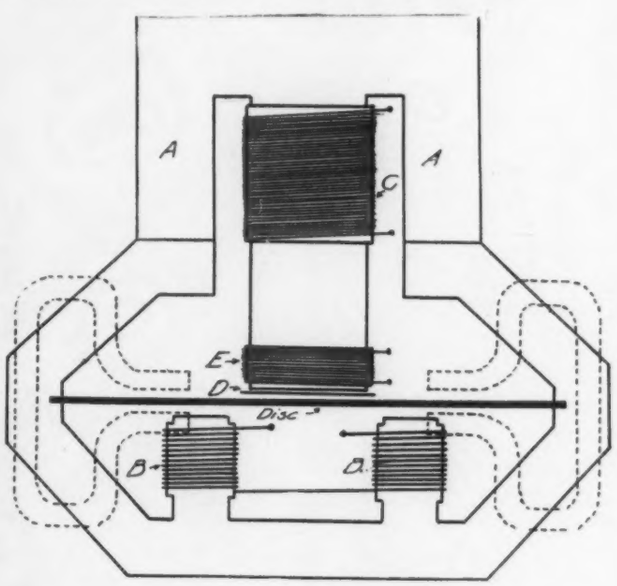


Fig. 15.

The weight of the moving element being less than that of the commutating type of meter, and the fact that it has no commutator with its resulting friction, necessarily eliminates an appreciable amount of friction and also results in less jewel wear.

For the above reasons, the induction meter will maintain its accuracy better with the same amount of attention than will other types of "motor" meters.

The induction meter is entirely free from commutator and brush troubles, having neither brushes nor commutator. It is cheaper in first cost than any other type of meter, suitable for use on alternating currents, which can compare with it in continued accuracy.

Principle of Operation.

The induction meter consists essentially of the stationary element, the rotating element (consisting merely of the shaft and disc), the recording mechanism, the jewel bearing and the retarding magnets.

The stationary element consists of the magnetic circuit, A, Fig. 15, which is built up of laminated steel punchings; the current coils, B; the potential coil, C; the light load adjustment, D; and the lagging coil, E. The current and potential coils are mounted as shown in the figure, in such a way that the magnetic flux set up by each of these coils will pass through the meter disc, and this alternating flux passing through the metallic disc will set up currents therein which will flow as indicated in Fig. 16, the disc acting virtually as the short-circuited secondary of a transformer. It will be seen from Fig. 16 that the currents set up in the disc by the potential coil P flow past the poles of the current coils, P', and that the currents set up by the current coils flow past the pole of the potential coil. These currents set up in the disc are in phase with the voltages producing them, since the circuit offered by the disc itself is non-inductive. The voltages in the disc which produce these currents, however, lag 90 degrees behind the **fluxes** set up by the coils on the stationary element, as an induced voltage is always 90 degrees behind the inducing flux. The flux is in phase with the current which produces it, the angle of hysteretic lag being negligible, so that we have currents flowing in the disc lagging 90 degrees behind the currents flowing in the meter windings.

The potential coil is wound with many turns of fine wire, and is therefore highly inductive, so that the current flowing in this coil is practically 90 degrees behind the impressed e.m.f. and the flux from the pole of the potential coil is brought to exactly 90 degrees behind the impressed e.m.f. by use of the lagging coil,

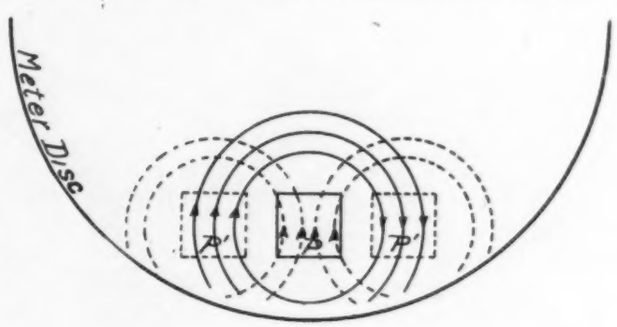


Fig. 16.

as will be explained later. The flux from the poles of the current coils will be in phase with the current, and therefore in the case of a load of unity power factor will be in phase with the impressed e.m.f. It can be readily seen from this that in the case of unity power factor the current set up in the disc by the potential coil (which lags 90 degrees behind the flux from the potential coil), will be in phase with the flux from the current coils, and also that the current set up in the disc by the current coils will be in phase with the flux from the potential coil. It will further be seen by referring to Fig. 16 that the disc currents set up by the potential coil will flow past the center of the current coil poles, and that the disc current set up by the current coils will flow past the center of the potential coil pole. This will give rise to a mechanical force tending to cause the disc to revolve, since any conductor carrying current at right angles to a magnetic field is subjected to a force which tends to move the conductor out of such field. Furthermore, this force

is proportional to both the current flowing in the disc and to the field strength or to the product of these two factors. In the case of the meter the current flowing under the pole of the potential coil is proportional to the line current, and the flux is proportional to the impressed e.m.f. Similarly, the current flowing under the poles of the current coils is proportional to the impressed e.m.f. and the flux from the current coil poles is proportional to the line current. The force tending to revolve the disc is therefore proportional to twice the product of the current and the voltage, or what is the same thing, it is proportional to the product of the current and voltage, or to the watts.

The principle of the induction meter's operation may be explained in a somewhat different way, which is perhaps more clearly understood; that is, the electrical element may be considered as the stator of an induction motor and the disc as the rotor. The "shifting" magnetic field in the case of a meter (which corresponds to the "revolving" magnetic field of the motor), is supplied by the current coil and the potential coil poles, the flux from the potential coil pole being 90 degrees out of phase with the flux from the current coil poles, as previously explained. This "shifting" magnetic field sets up currents in the meter disc, which reacting with the magnetic field produces a force tending to rotate the disc, exactly as the "revolving" field of an induction motor sets up currents in the rotor, which reacting with the "revolving" magnetic field produces a torque which causes the motor to run.

In the case of power factors which are other than unity, the flux produced by the current coils (which flux is in phase with the current), will no longer be 90 degrees out of phase with the flux from the potential coil, but will be 90 degrees plus or minus the angle of current displacement or the angle by which the current is out of phase. This being the case, the disc currents set up by these coils will no longer be in phase with the flux from the poles under which they flow, but will be out of phase by the angle of current displacement. The force tending to turn the disc will therefore no longer be directly proportional to the product of the current and the flux, but it will now be proportional to the product of the current, the flux and the cosine of the angle of current displacement, which is the power factor. Therefore the meter will still register the true watt-hours.

Another way of expressing this is to consider that the force acting on the disc will be proportional to the product of the flux and the **component** of the disc current which is in phase with the flux. Since the disc current is out of phase with the flux by the angle of current displacement, the component of the disc current in phase with the flux is equal to the total disc current multiplied by the cosine of the angle of displacement, or the power factor.

Lagging for Low Power Factor.

In order for the meter to register correctly on low power factors it is necessary for the flux from the pole of the potential coil to be **exactly** 90 degrees behind the impressed e.m.f. If the flux from the potential pole is less than 90 degrees behind the impressed e.m.f. the meter will run slow on lagging and fast on leading currents, while if the flux lags more than 90 degrees it will run fast on lagging and slow on leading currents. This condition is obtained by a method known as lagging, and is accomplished as follows: In figure 15 C is the potential coil, and E is the lagging coil which is mounted over the pole tip of the potential coil. The current in the potential coil will be not quite 90 degrees behind the impressed e.m.f., due to the RI^2 losses in the winding and the losses in the iron which give rise to an energy component of the current. The flux will be in phase with the current, and will therefore be not quite 90 degrees behind the impressed e.m.f. A part of this flux will pass through the lagging coil and on through the meter disc. This flux induces an e.m.f. in the lagging coil which is 90 degrees behind it in phase. This is shown by the vector diagram, Fig. 17. In this diagram OE represents the impressed e.m.f. and OI the current in the potential coil which lags not quite 90 degrees behind this e.m.f. $O\phi$ represents the flux set up by the current, which passes through the lagging coil and meter disc. This flux induces the e.m.f., OE', in the lagging coil, which is 90 degrees behind it in phase. The circuit of the lagging coil is closed through a resistance, the amount of which can be varied and therefore the amount of current flowing in this circuit

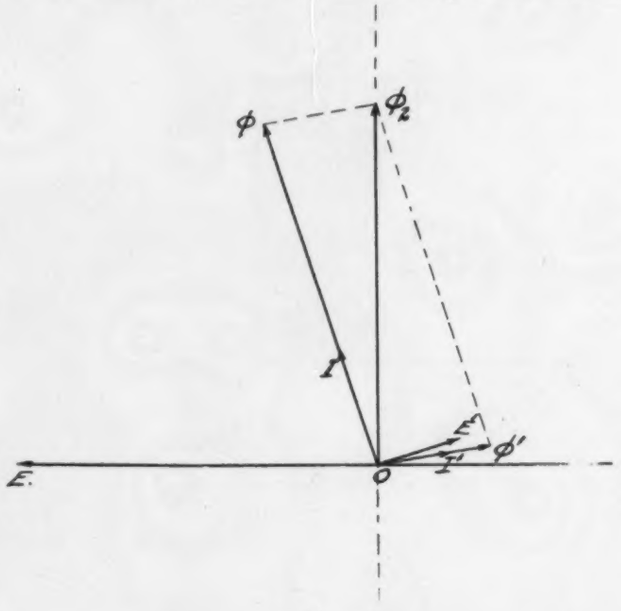


Fig. 17.

can be varied. This current is represented in the diagram by OI'. The current OI' will set up a flux $O\phi'$ in phase with itself, and this will combine with the flux $O\phi$, producing the resultant flux, $O\phi_2$, which will pass through the meter disc. It can be readily seen by reference to the figure that if the current, OI' is of the proper value, that this resultant flux $O\phi_2$ will be exactly 90 degrees behind the impressed e.m.f., OE. By adjusting the amount of non-inductive resistance in the circuit of the lagging coil, this condition can be very easily produced, which process is known as "lagging." A properly lagged meter will register with accuracy on low power factor. The method of lagging above described is used in meters manufactured by the General Electric Company.

The method of lagging which is employed in meters manufactured by the Westinghouse Electric

and Manufacturing Company is somewhat different from that which has just been explained, though the principle is essentially the same. In the Westinghouse meter the lagging coil consists of an adjustable short-circuited turn, placed on the pole tip of the potential coil. The position of this turn can be adjusted so as to obtain the required flux component to bring the **resultant** flux 90 degrees behind the impressed e.m.f. By referring to Fig. 18 it will be seen how this is

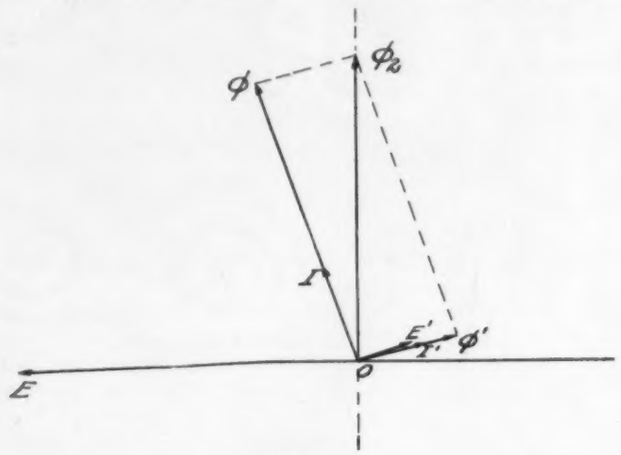


Fig. 18.

accomplished. OE represents the impressed e.m.f., OI, the current in the potential coil, OE′, the voltage induced in the short-circuited lagging turn, OI′, the corresponding current, and Oϕ' the flux set up by this current. Oϕ_2 represents the resultant flux which lags 90 degrees behind the line e.m.f. The proper value of the flux, Oϕ' can be obtained by varying the position of the short-circuited turn.

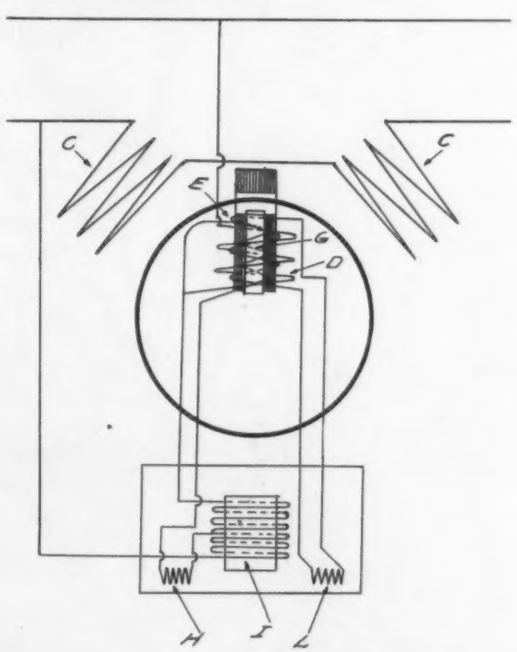


Fig. 19.

In the induction meter manufactured by the Fort Wayne Electric Works, the lagging device consists of two elements, one being wound on the light load adjusting arm (shown at G, Fig. 19), and is connected in series with the lagging resistance, H. This coil and resistance is shunted across a portion of the potential winding as shown. The other coil, E, is wound on the potential pole tip and is short-circuited through a resistance, L. In the vector diagram, Fig. 20, OE is the impressed e.m.f., OI, the current flowing in the potential circuit, which lags not quite 90 degrees behind the voltage, and Oϕ is the flux produced by this current.

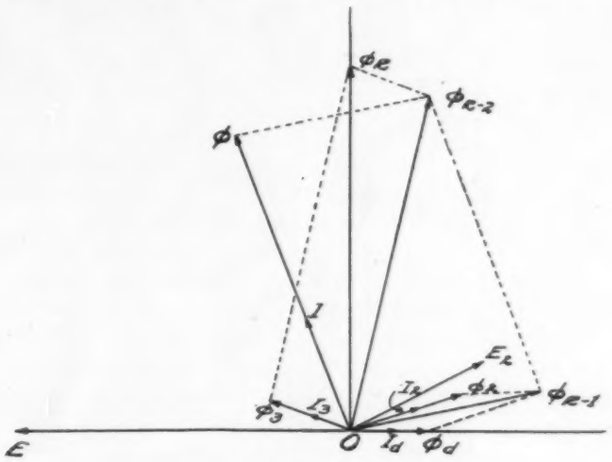


Fig. 20.

This flux produces the voltage OE$_2$ in the lagging coil, E, which in turn sets up the current OI$_2$, and the flux, Oϕ_2. The current induced in the meter disc by the potential coil also sets up a flux, Oϕ_3, in phase with itself. The resultant of Oϕ_2 and Oϕ_3, which is represented by OϕR$_1$, combines with Oϕ giving the resultant flux OϕR$_2$, which lags more than the required 90 degrees, and this is brought to exactly 90 degrees by the flux Oϕ_3 set up by the coil, G. The flux Oϕ_3, being almost in phase with OE, the voltage impressed on the coil being in phase with OE, and the circuit being closed through a non-inductive resistance. The proper amount of lagging is accomplished by adjusting the resistances H and L, which changes the values of the currents OI$_2$ and OI$_3$, and therefore the fluxes produced by them. Coil L is left open-circuited when used on 133 cycles, the flux from the meter disc producing the necessary lagging effect in conjunction with the coil, H. Such a meter as just described is "double lagged," since the 60 cycle meter can be used on 133 cycles by simply open-circuiting coil L.

Light Load Adjustment.

The light load adjustments of the various makes of induction meters on the American market are very similar in principle of operation, as is also the case with the power factor adjustments. The different manufacturers, however, use somewhat different methods of applying the fundamental principle as will be seen in the following descriptions:

The light load adjustment clip of the General Electric induction meter is shown at A in Fig. 21, and consists of a rectangular copper conductor which acts as a short-circuited loop, being so mounted that it can be shifted in a plane at right angles to the axis of the potential pole. This short-circuited turn has an e.m.f. induced in it, by the flux from the potential pole tip, which in turn sets up a current that is practically in

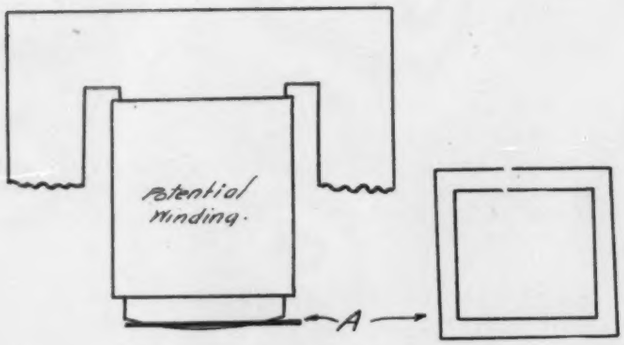
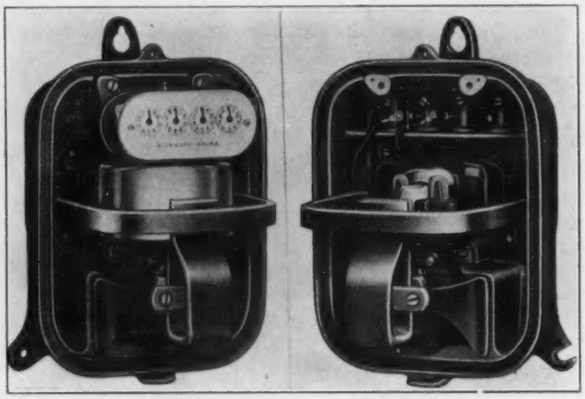


Fig. 21.

phase with this e.m.f.; the current produces a magnetic field which is out of phase with the flux from the potential pole. This flux from the light load adjusting coil reacts with the main flux from the potential pole tip and thus produces a turning effort which acts upon the meter disc. The amount of this turning effort can be varied by simply shifting the short-circuited turn, so that there will be a mechanical as well as a time phase displacement between the flux from it and that produced by the potential pole. The illustrations in Fig. 22 (a and b) shows clearly the construction of the General Electric Company's single phase induction meter



a Fig. 23. b

for ordinary house use, from which a general idea may be had of the parts entering into the construction of a typical induction watt-hour meter.

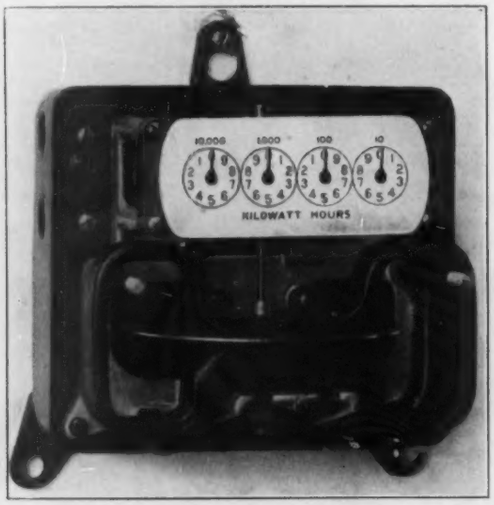


Fig. 22a.

The light load adjusting device of the Fort Wayne induction meter consists of a laminated iron arm which forms part of the potential pole, and upon which is mounted the short-circuited coils. The position of this arm can be shifted, the effect being similar to that described for the General Electric meter. Figure 23 is an illustration of the Fort Wayne company's single phase meter, and, as will be noted, the disc has a peculiar "cup-shaped" form. The illustration at (b) shows the ease with which the disc may be removed without disturbing other parts of the meter.

The light load adjusting device of the Westinghouse induction meter consists of two adjustable short-circuited turns so mounted that they may be rotated through a small angle. One side of each of these short-circuited turns is in an air-gap in the magnetic circuit

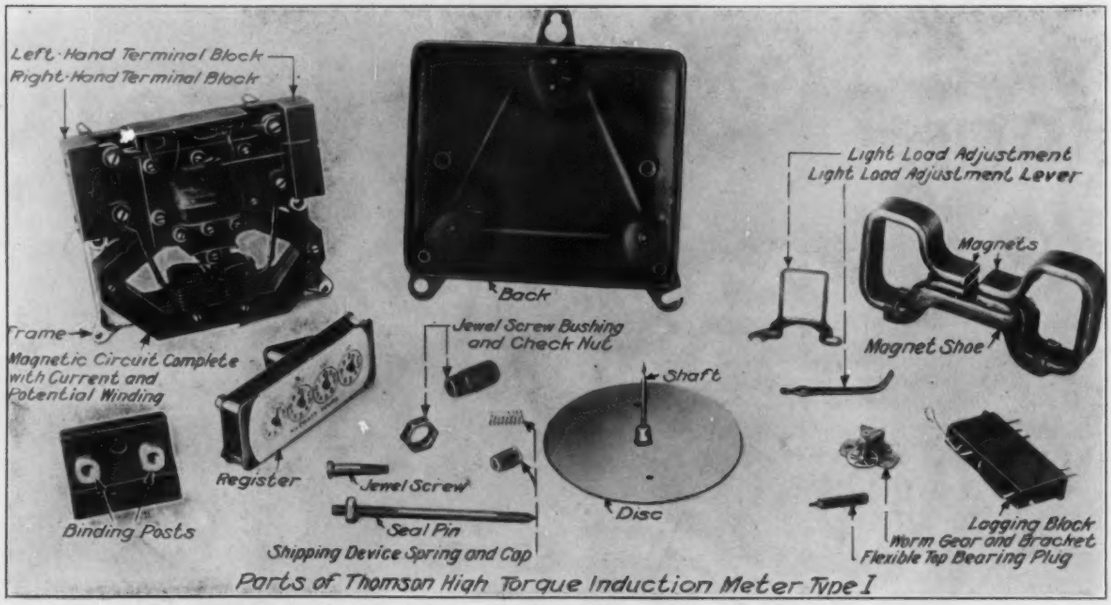


Fig. 22b.

of the potential winding and by partially rotating the turn it can be made to enclose more or less lines of magnetism, as can be readily seen from the diagram in Fig. 24 at A. The lines of magnetism, in passing through the short-circuited turns, induce currents therein, which currents set up an auxiliary field. This

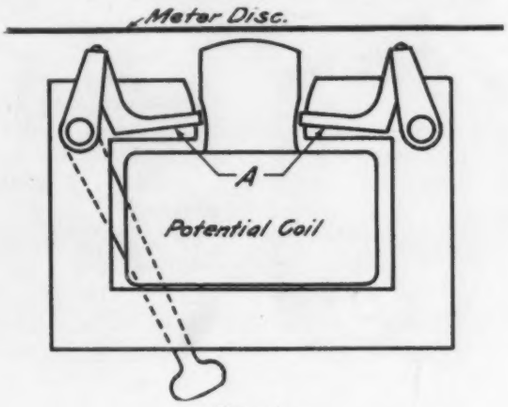


Fig. 24.

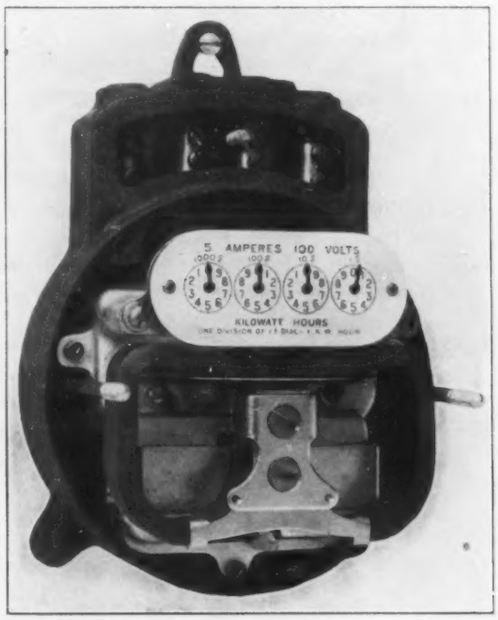


Fig. 25a.

auxiliary field is out of phase with the main field from the potential pole, and the two, acting in conjunction, produce a torque on the meter disc, the amount of which can be varied by moving the short-circuited turns so that they will embrace more or less of the flux passing through the air-gap. In Fig. 25 (a and b) are shown two views of the single phase type of induction meter as manufactured by the Westinghouse company.

The object of the light load adjusting device is to produce a torque from the potential circuit alone (independent of the load on the meter), the magnitude of which will be just enough to overcome the friction of the meter, therefore rendering it accurate on light loads.

Creeping.

If the light load adjustment is set so as to exert a torque greater than is actually necessary to overcome the friction it will cause "creeping" on no load. Creeping will also result if the light load adjustment is properly set for operation at normal voltage and then the meter installed on a circuit where the voltage is considerably above the normal voltage rating of the meter. A higher voltage will produce a higher flux from the potential pole, which in turn will induce a higher current in the light load adjusting coil, and this higher current and higher flux will mutually react and produce a higher no load torque, thereby causing the meter to creep.

Effect of Frequency Variations.

When an induction meter is operated on a frequency other than that for which it is adjusted, the lagging coil will no longer set up just the necessary flux to bring the resultant flux from the potential pole exactly 90 degrees behind the impressed e.m.f.; it will either be ahead or behind this correct 90 degree position, depending upon whether the frequency is below or above the normal value. Errors from this source will be inappreciable so long as the frequency is within 10% (approximately) of the normal value.

It is at the present time the practice of the leading meter manufacturers to design their 125 cycle and their 133 cycle meters so that by a simple connection

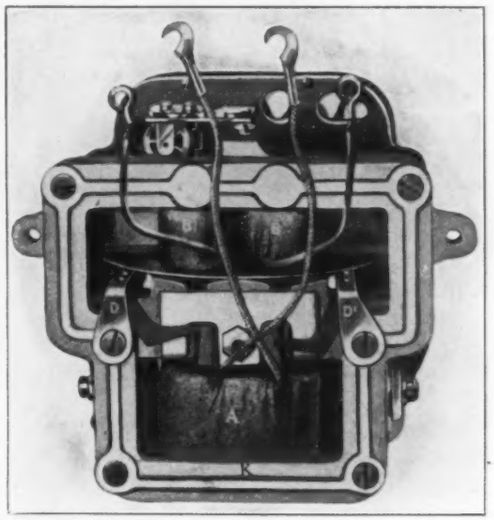


Fig. 25b.

or adjustment, which can be easily made, they may be used with accuracy on 60 cycle circuits. This is on account of the fact that 60 cycles is the standard lighting and power frequency, and as the majority of the higher frequency plants will sooner or later be changed over to 60 cycles, it will evidently be a great saving to them if they can use their old meters rather than have to purchase new 60 cycle meters when such a change may be made. Meters so constructed are known as "double lagged" meters, since they are lagged at the factory for two different frequencies.

The effect of a frequency other than normal can be best shown by reference to the diagram shown in Fig. 26, in which

OE=the impressed e.m.f.,
OI=current in potential coil at normal frequency,
OI_1=current in potential coil at low frequency,
OI_2=current in potential coil at high frequency,

OI_L, OI_{L-1} and OI_{L-2} = the currents in the lagging coil for these different frequencies.

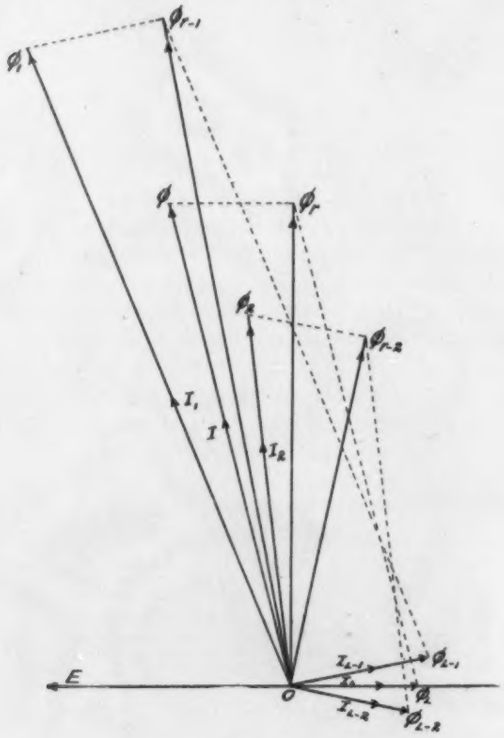


Fig. 26.

Now suppose that the meter is properly lagged for a frequency, f, the current in the potential winding being OI, and the flux therefrom being $O\phi$. The current in the lagging coil will be OI_L, and the flux therefrom will be $O\phi_L$; these two fluxes, $O\phi$ anc $O\phi_L$ combine to produce the resultant flux $O\phi R$, which is exactly 90 degrees behind the impressed e.m.f. Now suppose that the meter is used on a frequency, f_1, which is below normal. With a lower frequency the flux set up by the potential coil will be greater, as the rate of change of flux must remain the same. The magnetizing current, OI_1, will therefore be greater, the core loss and the RI^2 losses will be higher, so that there will be a larger energy component of the current, and it will therefore not lag by as great an angle as with normal frequency; the current OI_1 sets up the flux $O\phi_1$, which represents the condition for a frequency below normal. The flux, $O\phi_1$, combining with the flux $O\phi_{L-1}$, set up by the lagging coil at the lower frequency, produces the resultant flux $O\phi R_{-1}$, which does not lag to the 90 degree position, and in order that it be made to lag to the correct 90 degree position, it is necessary for the lag coil to set up a greater flux than $O\phi_{L-1}$, which can be accomplished by relagging the meter for this lower frequency, f_1.

Now in the case of a higher frequency, f_2, the current in the potential winding is represented by OI_2, and the corresponding flux by $O\phi_2$. Both the core loss and the RI^2 losses in the potential winding will now be less than in the initial case, the energy component will therefore be less, and the flux will lag more nearly to the correct 90 degree position. The flux, $O\phi_{L-2}$, now set up by the lagging coil, will combine with the flux $O\phi_2$, producing the resultant flux $O\phi R_{-2}$, which lags too much, being beyond the 90 degree position. In order for the resultant flux to lag to the correct position, it will therefore be necessary for the lagging coil to set up a flux less than $O\phi_{L-2}$; in other words, the meter would have to be relagged for this higher frequency, f_2.

Obviously, for power factors other than unity, serious errors would be introduced by using a meter adjusted for a frequency different from that of the circuit on which it operates; the meter might either run fast or slow, depending upon whether it is adjusted for a higher or lower frequency than that of the circuit on which it operates, and upon whether the current is lagging or leading.

The effect of a frequency above normal will be to make the meter run fast on lagging currents and slow on leading currents; a frequency below normal will cause the meter to run slow on lagging currents and fast on leading currents. For unity power factor there would also be an error introduced, although it would not be so pronounced as in the case of power factors other than unity. In this case only that component of the flux from the potential pole which is in the correct 90 degree position will be effective, so that the phase displacement of the resultant flux will tend to make the meter run slow on any frequency other than that for which the meter is adjusted. The values of the resultant fluxes are not strictly proportional to the frequencies, however, since the component supplied by the lagging coil is not proportional to the frequency and its angular relation to the main component is different for the different frequencies; also for lower frequencies, the energy component of the voltage is greater and the reactive component is less, due to the increased shunt current which tends to make the meter run slow, and vice versa for higher frequencies.

The currents induced in the meter disc by the current coils should be directly proportional to the frequency, but due to the demagnetizing effect of these currents on the current coil poles, this condition is not strictly fulfilled, which causes the meter to have a tendency to run slow on frequencies above normal and fast on frequencies below normal.

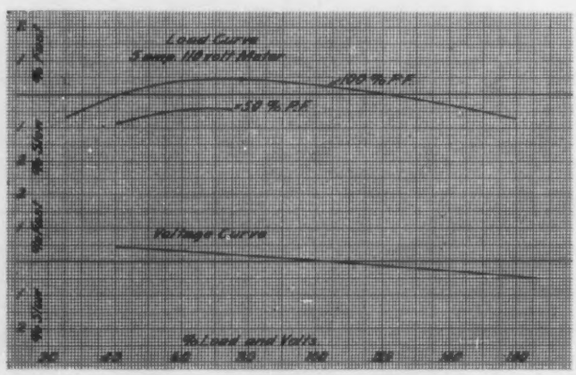


Fig. 28.

The resultant effect of the different disturbing factors above mentioned will affect the meter to an extent dependent largely upon the design.

Figure 27 is a curve showing the accuracy of a

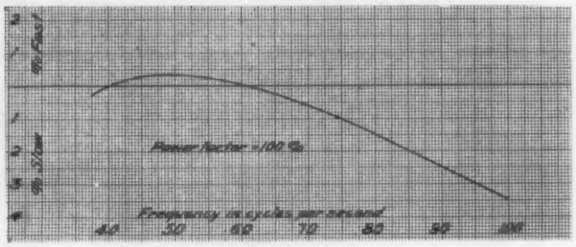


Fig. 27.

standard make of induction meter on different frequencies at unity power factor, and Fig. 28 shows the load and voltage curves of a standard 5 ampere induction meter operating at normal frequency.

(To be Continued.)

CARE OF HIGH-VOLTAGE INSULATORS.

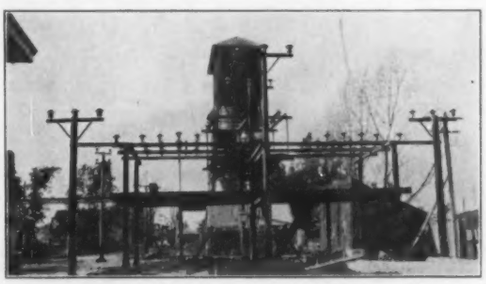
BY J. O. HANSEN,

Superintendent Pacific Gas and Electric Company's San Jose Power Division.

J. O. HANSEN

The large insulators, supporting the wires and insulating the high-voltage currents on the transmission lines, while ordinarily performing their peaceful allotted duty, are are at the same time doing strenuous work, and, if not properly cared for become overburdened. Then there is at the best a momentary disturbance. It is noticed on the lights as a blink or on the motors as a groan.

On the system of the Pacific Gas and Electric Company there are more than 100,000 high-voltage insulators. Their efficiency must be great to avoid an average of one breakdown a week, and even that is too frequent. But at this rate the average life of an insulator would be nearly 1,000 years. This, of course, is



Insulators on Switches at Petaluma.

not reckoning on breaks due to mechanical causes. The small boy with a stone is often the most frequent cause for a mechanic on the job, and the small boy is closely seconded by the unsuccessful hunter who must use his ammunition on something.

A few hundred insulators put under test will undoubtedly make a satisfactory showing. But there must be very general great reliability for all climatic conditions. In the intensely foggy and windy climate about San Francisco bay insulators are things that require careful watching and attention. Insulators made to stand a rain or wet test will render good service in fog and wind when they are clean, but, when dirty, their insulating quality becomes much impaired.

The heavy winter rains keep the insulators clean a part of the year. During a dry spell of from one to two months so much dirt will have collected on the insulators that when they become wet there will be enough current leak over to fire the pole. The soft redwood or cedar pole itself catches fire much more easily than the pine cross-arms. When iron pins are used, and are shorted by wire, the leakage current may be entirely between the wires over the insulators or the leak may be between a wire and the ground, and then fire the pole. But by running the shorting wire to the ground, the pole is thoroughly protected from such burning. Still the leakage current is present, and, if allowed to become large enough, through the wetting of the accumulated dirt by fogs or light rains, an arc forms which either shatters the insulator or burns the transmission wire in two. In the majority of cases

On the Pole Line Between Berkeley and Elmhurst.

either of these accidents is easier to repair than a burned pole. With the iron insulator pins shorted and grounded more current and consequently a greater accumulation of dirt and dampness are required to start trouble, so that more time can be allowed between cleanings of the insulators. The dirt accumulates over all parts of the insulator in an even layer. But an insulator that has been on the line through the winter has more dirt left on the protected parts than on the exposed parts where the rain has washed some of it off.

For this reason the suspension type of insulator is better than the pin insulators, because in the suspension type a larger percentage of the entire surface may be washed off by the rains. The method of supporting by a large clamp is also probably better than by a small tie wire on the pin insulators, because of the difference in corona discharges from small and large diameter surfaces.

First dry cloths were used in cleaning the insulators. Later it was found more effective to apply gasoline on the cloths to cut the dirt and grease. But because gasoline evaporates so quickly kerosene is now being used with good results. The best cleaning is with clear water applied with a hose. All parts are then washed off without any residue being left on the surface.

An insulator made to hold up under all of the dirt that will accumulate on it during a season and have its surface so exposed that the winter rains will thoroughly clean it, should give satisfactory results. The problem then presented is whether it will be cheaper to use small insulators and pay to keep them clean or use large insulators which will withstand the dirt and fogs through the summer and be automatically cleaned by the winter rains washing them.

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CORRECTION:—Figs. 12, 13a and 13b in the chapter on "Watt-Hour Meter" appearing in the issue of March 5, 1910, are wrong. The connections from the neutral wire of 12 should be joined to all three meters, instead of to but one, as shown in the diagram. In 13b the lead from the load side of current transformer No. 2 should connect to the lower current lead of the meter. The connections of the current transformers in Fig. 13a should be the same as in 13b.

Talk Up

Local branches of the national engineering associations have been established in a number of Pacific Coast cities and unlike many similar organizations in the East, they discuss original subjects. These subjects are of especial concern to Western men, because they deal with problems peculiar to the West. Many of the matters presented in the Eastern meetings do not directly bear upon Western conditions. Likewise it may be said that some Western problems do not immediately interest Eastern men. It is, therefore, mete that the local sections, representing the best engineering talent of the community, should discuss those problems which are arising in their daily work.

The interchange of practical ideas in the ensuing discussions is frequently more valuable than those developed in the formal papers. Members are consequently encouraged to express themselves freely upon those subjects with which they are familiar. Unfortunately some men seem to be so constituted that they are fearful of talking on their feet. There is nothing more discouraging than for a speaker to carefully prepare a discussion which seems to fall upon deaf ears so far as any response is concerned. This apparent lack of interest is deplorable and calls for vigorous action in stimulating what should become the most important feature of these meetings.

Public Service Corporation

One by one in the different states of the union blossoms the public service board, the anemone of the reformer. After Massachusetts came New York and Wisconsin, with strong probability of like action in Maryland and New Jersey. The idea of a public service commission is contagious, and there are few state legislatures which will not be asked to pass on the matter during the coming sessions. Municipal control, state regulation and federal supervision combine to threaten a corporation over-regulation which may yet prove as disastrous as corporation over-capitalization. Such a movement carried to its extreme can be but a business detriment.

There are few thinking men who will deny the benefits of some authoritative check on corporation rapacity. In California, at least, municipal control has proved satisfactory to neither the public nor the corporation. Recent developments at Washington show that federal supervision is likely to prove a farce under the present provisions. The experience of Massachusetts, New York and Wisconsin proves that regulation has many desirable features. It limits that exhaustive competition which ruins legitimate investment, and it protects the stockholders from unwarranted expenditures. Its chief function, like that of the railroad commission, is rate regulation whereby consumers will be served at the lowest price consonant with fair returns on the money invested. If this beneficial regulation can be confined to the adminis-

tration of one set of commissioners and not diffused through a municipal, a state and a national body, it is likely to solve many pressing problems.

What It Costs

A careful and analytical study of the report upon the Pacific Telephone and Telegraph Company for the year 1909, made for the City of San Francisco by C. L. Cory and published in the March 5th issue of the "Journal of Electricity, Power and Gas," should be of benefit to engineers, stockholders in such companies, and the customers of public service corporations. One need not be interested in the facts and figures there presented, referring to the telephone industry only, to appreciate the necessity of every successful corporation giving attention to the details of their business, not only to the physical equipment and the operation of the system, but also to the methods of accounting required to accurately determine unit costs.

Referring to a single set of figures obtained as a result of the investigation and included in the report, it is stated that the average revenue or amount paid by the customer per telephone station per month, covering a period of two years, divided, however, into four equal periods of six months each, was as follows:

January to June, 1908, per month	$4.233
July to December, 1908, per month	3.714
January to June, 1909, per month	3.689
July to December, 1909, per month	3.492

In referring to these figures the report sets forth that the reduction in the revenue per telephone station, or the reduced cost to the customer of the telephone service, is due in part to the reduction in rates and in part also to the increase in the number of telephones installed and operated, meaning thereby that the capacity of the system as at present installed is being more nearly completely utilized.

It is needless to say that every corporation should not only keep careful and accurate accounts properly segregated, but in addition should use the results of the analysis of these accounts to plan for the future, so that it will not be necessary to hastily and under great stress do temporary and, in the end, expensive work in order to keep pace with increased business, but, on the other hand, with as many facts before them as are obtainable, plan each year's work ahead so that the required extensions will be of a permanent character and in conformity with the plant as a whole.

Economy is a word which probably means as much to the engineer as to any individual. To improve the economy of operation is the constant work of many engineers. Manufacturers consistently try to build apparatus of the highest possible efficiency, but it is certainly apparent that without wise and far-seeing management in the building and extending of the plant and system of a company, all the apparent saving in the purchase and installation of the most efficient apparatus would be more than wasted by careless or unwise management in the construction and operation of the system.

Conclusions for the guidance of the directors, managers and engineers of such a company can only be of use if based upon facts and sufficiently reliable information so that the results will be in accordance with the ultimate requirements. What is required is good judgment in estimating for the future. Unfortunately, instead of systematically and in detail keeping accounts, the analysis of which will be of value, disastrous results often come from pure off-hand guessing, and it is not surprising that in such cases a time always comes when the failure to first obtain facts results in ultimate disaster.

Consumers very seldom, if ever, give thought or credit to the work of the men who are continuously occupied with such problems. It requires constant effort, a broad perspective and the ability to wisely balance many divergent and complex elements to arrive at approximately correct conclusions even with every possible fact available. Increased economy and reduction in the unit cost of operation is being obtained every day, and it is unfortunate indeed that sufficient publicity is not given by the corporations to such matters so that their customers may appreciate what is constantly being done in their behalf. Increased quality of service, coupled with decreased cost, has resulted in the past and will continue in the future as long as the state of the art improves and an advance in science and engineering continues.

A United States senator whose name has been very conspicuously identified with the recent tariff bill is responsible for the assertion that the affairs of the United States government are run at a cost to the people three hundred million dollars in excess of what the administration would cost if conducted with the economy of the large corporation. Whether this assertion is true or not, it must be admitted that federal, state, county and municipal affairs are not efficiently and economically administered.

Perhaps it may be due to the employment of men not particularly fitted or trained for the work they are supposed to do, since they hold their positions in many cases as a result of favoritism rather than effectiveness. If in such matters complete accounts showing unit costs were insisted upon by those in general charge, the real cause of the inefficiency of such institutions would certainly become more apparent, and it must be remembered that in the procuring of the best data, time is often a necessary element, and when continuous records can be obtained and compared there is a real hope of surely and unquestionably proceeding in the right direction.

PERSONALS.

H. F. Brizard of the Arcata Light & Power Co., of Arcata, Cal., is in San Francisco.

H. C. Thaxter has joined the sales engineering force of Woodin and Little of San Francisco.

Sidney Sprout, electrical engineer, returned during the week from a trip through the Northwest.

C. E. Condit, president of the Nevada Machinery Co., of Reno, Nevada, was a recent visitor in San Francisco.

C. R. Ray, who has extensive electric power interests in Southern Oregon, is a recent San Francisco arrival from Medford, Oregon.

Russ Wolden, of the California Electrical Construction Company, San Francisco, has returned to business, after having been ill for the past six months.

G. A. Schneider, engineer with the San Francisco office of the Western Electric Company, recently went to Lovelock, Nev., on engineering work.

N. H. Dohrman, who went to Parral, Mexico, a few months ago as manager of a new electric light and power plant, has returned to San Francisco on a visit.

William D. Ward, of the sales force of the Pelton Water Wheel Company, of San Francisco, has returned from a successful trip to Southern California.

W. S. Heger, the new manager of the Allis-Chalmers Company's San Francisco office, returned from the South during the week, after visiting his Los Angeles office.

R. S. Masson, engineer of the Electric Operating & Construction Company, recently passed through San Francisco bound for Portland and is now on his way to New York.

K. Casper, of Vallejo, who is at the head of the distributing company that distributes the current of the Pacific Gas & Electric Co., was a San Francisco visitor during the week.

Charles L. Zahn has been made engineer in charge of the construction of the Independent telephone properties at Spokane, Wash., controlled by Thaddeus S. Lane and associates.

Frank J. Campbell, of Denver, has been elected president of the Nevada-California Power Company, in place of Delos A. Chappelle, resigned. Mr. Campbell will make his headquarters at Goldfield, Nevada.

A. S. Kalenborn, chief engineer of the Truckee River General Electric Co., of Reno, Nevada, recently addressed the engineers' club of the University of Nevada, on the subject of the company's system.

H. L. Jackman, manager of the Humboldt Gas & Electric Company, of Eureka, Cal., was among the visitors to San Francisco during the past week. Eastern capitalists have an option on the holdings of his company.

Wynn Meredith, who is at the head of the San Francisco office of Sanderson & Porter, recently left New York on his return trip. He is taking the southern route and will stop off for a few days in Los Angeles.

George R. Murphy, sales engineer with Pierson, Roeding & Co., has returned from the East, where he perfected arrangements whereby Pierson, Roeding & Co. take over the Pacific Coast offices of the Electric Storage Battery Co.

Leon M. Hall, consulting engineer for the Comstock mines, has returned from Virginia City, where he inspected a new electrically-driven centrifugal pumping installation in connection with the mine drainage system of the Comstock Lode.

C. W. Stone, assistant engineer of the lighting department of the General Electric Company, of Schenectady, and D. R. Bullen, manager of the company's supply department, have gone to Southern California after spending several days in San Francisco.

Announcement

The rapidly increasing business interests of the Journal of Electricity, Power and Gas throughout the East have for some time required more prompt attention and better service than has been possible in handling such business from the San Francisco office. On this account we have established an eastern office at 150 Nassau St., New York, in charge of *Mr. C. N. Manfred*. Mr. Manfred is so well known among eastern advertisers that an introduction is hardly necessary. His long and active career in advertising work as advertising manager for the Ohio Brass Co., of Mansfield, Ohio, and later with the H. W. Johns-Manville Co., New York, in a similar position, is well known to many of our advertisers and readers. We feel extremely fortunate in securing Mr. Manfred to represent the Journal in the East, as we know that his experience will be of considerable benefit to both our present and prospective advertisers.

BANQUET OF LOS ANGELES ELECTRICAL MEN.

A joint banquet of the American Institute of Electrical Engineers and the Sons of Jove is to be held at the Hollenbeck Hotel on March 12, 1910. The speakers announced are: J. A. Lighthipe, "Early Days in Thomas A. Edison's Laboratories;" E. R. Northmore, "The Lighting Companies;" C. W. Koiner, "The Institute;" E. F. Scattergood, "Engineering;" O. H. Ensign, "Reclamation Service;" A. W. Ballard, "Sons of Jove."

BOOKS RECEIVED.

"Gas, Gasoline and Oil Engines," by Gardiner D. Hiscox. 450 pages, 6x9 inches, 412 illustrations. Norman W. Henley Publishing Co., 132 Nassau St., New York City, and Technical Book Shop, San Francisco. Price, $2.50.

The appearance of the eighteenth edition of this well known compendium of the gas engine vouches for its usefulness and requires little comment from the reviewer. The present edition has been so revised, rewritten and augmented that it is as representative of modern practice as it is possible for a text-book to be. The most important additions are in a new section on producer-gas plants and one on oil-vapor motors.

Illumination and Photometry. By W. E. Wickenden; 195 pages; 6x9 in.; 114 line illustrations, numerous tables. McGraw, Hill Book Co., New York City, and the Technical Book Shop, San Francisco. Price, $2.00.

This volume is intended as a text-book on the subject of illuminating engineering, and consequently considerable space is devoted to the scientific basis of the subject. It is sub-divided into fifteen chapters and an appendix. The subjects treated include the theory of light and of optics, photometry, the various types of electric and gas lamps and the practical calculation of illumination for both interior and exterior needs. The appendix contains tables and charts facilitating computation and estimating. Most of the treatment pre-supposes a knowledge of elementary physics and chemistry and an understanding of the calculus. To mathematics is due much of its admirable clarity and brevity. The treatment appears comprehensive, embracing as it does all practical methods of illumination and its calculation. When comparisons are made the utmost fairness has been employed as to the advantages and disadvantages of various types of illuminants. As a whole it is a valuable addition to the literature on illuminating engineering.

INDUSTRIAL

A NEW OIL AND TRANSFORMER DRYING DEVICE.

It is almost impossible to prevent moisture from being deposited in transformers during transportation or storage, as condensation takes place on the surface of the oil and metallic surfaces whenever these are cooler than the surrounding air. It is of the utmost importance therefore that adequate means be provided for drying out the transformer and oil.

The device shown diagrammatically in the cut, designed for this purpose, is manufactured by the General Electric Company, and consists of a hot air furnace, positive pressure blower, dust collector, driving motor, and necessary piping, pulleys and belt. Hot air, free from dust, is forced into the transformer through the oil valve in the base of the tank.

The hot air furnace contains a 3-inch wrought iron coil suitably supported inside a sheet iron casting, the whole being mounted on a cast iron base. The furnace is designed much like a self-feeding stove, two doors being provided, one at the top of the furnace for the admission of fuel, and one at the bottom for removing the ashes and also regulating the draft. Wood and charcoal have proved in actual experience to produce satisfactory results as fuel, but hard coal may also be used if forced draft is provided, which can be easily accomplished, by tapping the pipe between the blower and the furnace. Standard 3-inch wrought iron piping is used throughout, but as it is procurable almost anywhere, only the connection between the blower and the furnace is furnished by the manufacturers. If the connections between the furnace and the transformer tank are of appreciable length it is advisable to cover them with heat insulating materials to prevent the loss of heat.

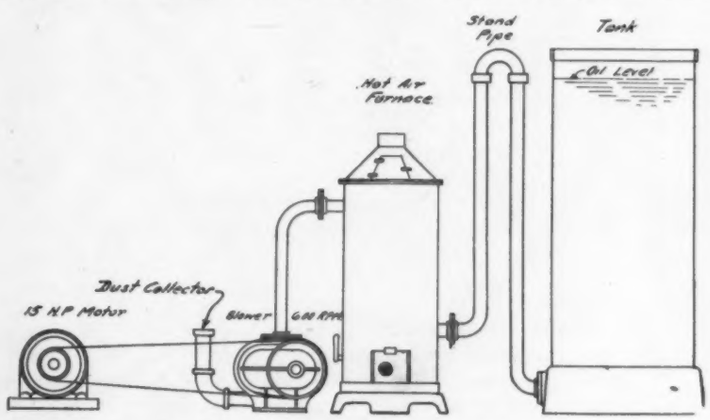
The positive pressure blower has a normal capacity of 300 cubic feet of free air per minute delivered at a pressure of 6 lbs. per square inch, is designed for a speed of 600 r.p.m., and requires 15 h.p. to drive it when delivering normal output.

The dust collector or air filter, consists of a perforated sheet metal pipe 4½ in. in diameter, connected to the blower with a suitable elbow and forms the point of entrance of the air to the blower. Cheese cloth should be tied around the pipe so that the air in entering the blower may pass through it and the dust be retained in its meshes.

Any available power, as a steam engine, gas motor, electric motor, etc., will drive the blower satisfactorily. The piping between the furnace and oil tank is extended above the oil level to prevent flooding the furnace with oil if the valve in the base of the tank is not closed when the blower is stopped.

The method of its operation is as follows:

After the fire has been started in the furnace the fan should be put into operation. The air is drawn through the dust collector which frees it from all impurities and is then heated in the furnace to approximately 100 deg. C. The hot air being forced through the transformer and oil at a pressure of 6 lbs. per square inch, absorbs all the moisture and raises the di-electric strength of both the oil and windings to its original value. No hard and fast rule can be given as to the time actually required for thoroughly drying out the transformer, but it is believed for ordinary cases of moisture, that a 10-hour run after maximum temperature is attained, will be sufficient. Break-down tests should be made from time to time on samples of the oil taken from the transformer, and the drying continued until the oil is able to withstand a puncturing test, the value of which is prescribed by the transformer manufacturer.



Oil and Transfomer Drying Apparatus.

A NEW ELECTRIC IRON.

The pretty electric iron shown in the accompanying photograph is the latest creation of the Pacific Electric Heating Company of Ontario, Californa, and Chicago. It has the same features that have made this electric iron so popular with the housewife heretofore: the cool handle, hot point, the attached stand, and guarantee.

Pacific Electric Iron.

A pressed steel top covers the entire iron, the asbestos mat included. A new steel encased plug has its insulation perfectly protected, and is practically indestructible. It has a patented method of attaching the cord, avoidng the usual wearing off of the insulation where the cord enters the plug.

Although the same principles of construction govern the making of the 1910 elements, they occupy less room, and when the pressure plate which holds them in place is removed, the elements can be lifted out. They lie loose in the bottom of the iron. The entire iron is given a sparkling mirror finish that is unusually attractive—a finish that electric iron makers previously have not thought worth while. This, with the ebonized handle of the 1910 Standard Hot Point Iron will have much to do with the big sales, the new iron will be sure to enjoy.

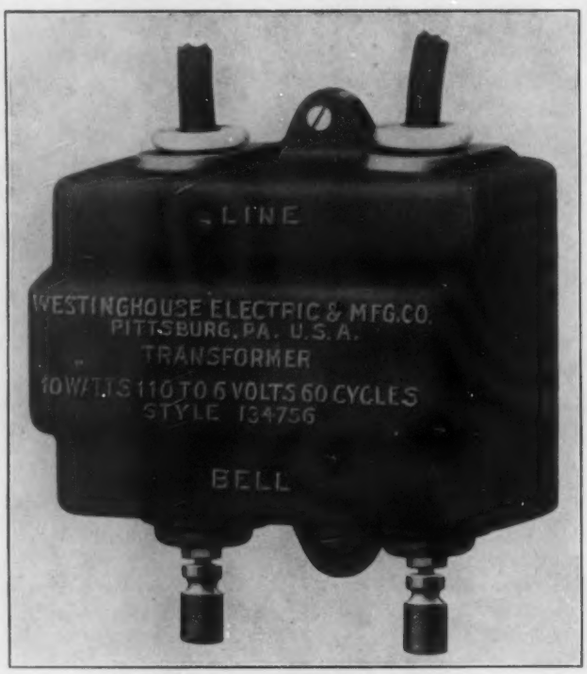
The Pacific Electric Heating Company is getting out a class of printed matter out of the ordinary for their dealers. Printed matter that is strong as well as attractive. The two year guarantee that has just been launched will have a more than ordinary pulling influence with the dealer. It is a guarantee directly between consumer and manufacturer. Nothing about it to bother or hold the dealer responsible.

The Pacific Electric Heating Company, as this edition is coming off the press, is announcing a series of laboratory tests made with three of the most widely known irons. Blue prints, and full details are being sent all dealers. And further still directions that the dealer may make the same tests for himself.

The Pacific Electric Heating Company is not putting out the only good electric iron on the market. But it certainly has an iron worth while, an iron that will stand the most severe tests—an iron that speaks for itself. The Hot Point Automatic model is the only electric iron fully approved by the National Board of Fire Uunderwriters. The Hot Point Standard and Automatic models were awarded grand prize (highest award) at the Seattle Exposition.

BELL RINGING TRANSFORMER.

Of course, you have experienced the time when you failed to receive an important telegram just because your door-bell was out of order and the messenger boy went away in disgust after almost breaking his knuckles in his efforts to call you. And you will be glad to know that a bell-ringing transformer has been brought out to displace the old-time batteries that have such a chronic habit of "running down." The



Bell Ringing Transformer.

new transformer brought out by the Westinghouse Electric & Manufacturing Company is a device that will permit the use of the regular lighting current in ringing your door-bell.

The advent of the bell-ringing transformer marks another wonderful stride in the application of electricity to modern life. It relieves another care and does so at a very small expense; it will displace five or six ordinary house batteries, and will last a life time. The operating cost is almost nothing. The original cost of this bell-ringing device compares favorably with that of the house battery system, and as it requires neither repairs nor renewal it is a much cheaper device in the end.

The Philadelphia Company of Pittsburg, Pa., has thrown out its batteries and is equipping its entire building next to the Public Safety Building, on Sixth avenue, with the Westinghouse bell-ringing transformers.

TRAIN DESPATCHING BY TELEPHONE.[1]

BY C. H. GAUNT.

We have not yet reached the stage of progress where one might ask, "Is the telegraph doomed?" Certainly it is not doomed when its application to the transmission of intelligence to great distances is taken into consideration nor when we reflect upon the great wireless projects of the future. But there is one direct use of telegraphy that is seriously disturbed, and that is its application to the necessities of modern train despatching.

The telephone has been in general use just about thirty years. At the very start the question was asked "Why cannot this improved means of transmitting words be used in the despatching of trains?" The grave and earnest men whose mental machinery seemed to work to perfection through the instrumentality of the telegraph said "No." The high officials of the railroads did not feel that the well working system was susceptible of change without risk, and risk is always to be avoided when there is not an immediate and good reason for assuming it.

Hardly a man of large influence in the field of train operation advocated the supplanting of the telegraph by the telephone during the first twenty-five years of the latter's successful use. Even after the clear long-distance transmitter had been generally established the railroad managers hesitated to interfere with the long wedded union of the telegraph with train movement. But the fine, practical minds of our great railroad managers have to be suddenly changed sometimes when a combination of circumstances brings about a result that has not been foreseen. Some may claim that the use of the telephone in despatching trains has long been advocated. Possibly so, but only during the last few years have trials been made of sufficient importance, and upon a large enough scale, to prove anything. When proof is demanded by a practical-headed train despatcher, it must be capable of but one construction—absolute.

The Santa Fe established its original telephone train-despatching circuit in June, 1908, in the dry climate of Colorado. It was not fitted with the improved apparatus now available, but there could be only one construction placed upon the reports received upon its operation—it was a success. As soon as this was realized immediate steps were taken to extend the introduction of the system to widely separated sections of the lines so as to test it in all conditions of climate. During the early part of 1909, 1962 miles of telephonic train-despatching circuits were in operation upon the Santa Fe Railway in the States of Missouri, Kansas, Illinois, Colorado, New Mexico and California. The longest circuit reaches from Fresno, Cal., to San Francisco, 203.1 miles, contains thirty-two stations and is successfully operated through the "fog belt" adjacent to San Francisco, where the telegraph is used only with great difficulty. The operating circuit upon all of these lines is a pair of 210-pound-per-mile copper wires carefully strung and costing in the neighborhood of $100 per mile. There is at present under construction 1520 miles more, which will give a total length of about 3482 miles of telephone circuits.

The results of this extensive trial, while really astonishing, should hardly be so considered, for they are but the natural consequence of human tendency, and an analysis of the telephone method will convince anyone that it will almost completely displace the use of the telegraph in moving trains, notwithstanding the expense of installation and the difficulty in overcoming the force exerted by the widespread use of the telegraph method.

The telegraph is used by the train despatcher in the intricate operation of his trains for one purpose only, that of communicating with the operators scattered along the stretch of railroad. Long use has developed a certainty of action in telegraph manipulation that commands the respect

[1]Santa Fe Employees' Magazine.

of all. But how often has a half frantic despatcher, loaded down with the complicated problems before him, wished he could use his voice to the men with whom he must communicate and thus avail himself of the rapidity of action, the definiteness and security that would follow?

To the despatcher time is the one thing that must receive the greatest consideration. It may be assumed that a man can utter words with a speed equal to the operation of his mind. But the train despatcher, in using the telegraph, has always been obliged to transmit his words at a speed but one-tenth his capacity to express himself, and also to receive a reply at the same rate. That being the case, of course a train-despatching system had to be adopted that would deal with a very small number of expressed ideas, and eternally and always the despatcher must come down to the limitations of the telegraph. In other words, the whole operation is inharmonious and does not tend to a result along the most natural channel. True, in the issuance of "orders" themselves, the speed, in telephonic manipulation, is limited to that required to write the words in longhand. But all directions of a collateral character, the receipt of important information and the instantaneous descriptions of situations that a despatcher must understand can be given and received at a speed limited only by that of human utterance.

And what does that mean? It means that the despatcher has been permitted to multiply the time within which he may form his plans of train operation fully three times. This, of itself, further means that his mental calculations are vastly improved in accuracy and general value. The despatcher is permitted to issue his orders at the times he originally outlined, and there is a coherence, a consistency and a union in his methods not possible where less time is available. This condition largely reduces the liability of error of action and, conversely, allows additional time for the discovery of error, important or unimportant.

By the use of the telephone the despatcher is relieved of that long continued and aggravating operation of calling an office by repeating over and over the telegraphic letter or letters used for that purpose. There is established at each office along the road, in the same circuit with the telephones, a small and compact instrument called a selector. Connected with the selector at each office is also an electric bell operated by a couple of cells of dry battery. The despatcher has within easy reach a number of buttons upon a board, each button being designated by the name of the station that it is designed to call. By merely pressing such a button the selector in that particular station is operated, to the exclusion of all others, and in a few seconds the bell is ringing loudly. And, to show the completeness of this calling arrangement, the despatcher also hears in his telephone receiver the flutter of the bell and therefore knows that it is ringing. The despatcher can stop the call when he likes, and a short ring generally arouses an immediate response. But, if not, the call may be continued until the answer is received, something that does not often occur, because an excuse for not answering does not have the same weight where a bell rings loudly that it does where an instrument may be feebly ticking off the call. And if it were not enough that the time used in calling offices should be practically eliminated, there is the further advantage that these calls may be made upon the line at the same time telephonic conversation is being carried on, one operation not interfering with the other.

If the operator at the station wishes to communicate with the despatcher, he simply removes the telephone from the hook, places it to his ear, and if there is an opening for him he states the name of the station and the despatcher instantly replies by saying "Despatcher." The "reporting" of trains—that is, the stating of the time of passing or of the arrival and departure of trains at stations—is made to the despatcher much more quickly than is possible by telegraph, and, where messages are necessary, they may be transmitted by telephone with the speed at which the operator and despatcher may be able to write longhand, and with equal accuracy to the telegraph. Information regarding derailments or other trouble is conveyed to the despatcher by verbal and complete narrative, either by the station operator or the conductor of the train involved, so that the despatcher is in immediate touch with the situation, while in using the telegraph for this purpose message after message is required before there is a complete understanding of the details.

In transmitting "orders" by telephone, the despatcher spells out in full the names of stations, numbers of engines and trains, the times and the proper names involved. This, however, is done with speed and precision, and the despatcher writes the order in the record before him as he gives it, not waiting to make the record when it shall be "repeated" to him by the operator, as is done in the telegraph operation. This change in making the record of the order from a subsequent to an initial one is very important from the standpoint of absolute accuracy.

Unquestionably there are doubters still of the complete success of the telephone in train despatching and the allied services. The change—if it may come—from the use of the telegraph to the telephone in moving and making up trains, in the handling of the thousand and one details connected with the immediate motion of traffic and in giving to all the employes concerned in the work the benefit of the interchange of judgment through direct conversation, is revolutionary.

But it brings quick action where formerly it was slow. It takes from the despatcher the necessity for operating his trains through the medium of a large number of telegraph operators of varying ability. It brings to bear upon this most important of services direct conversational contact between all the interested parties, something of greater value to this particular work than can be fully described. There is harmony of action, harmony of temper, human understanding and personal relations of the most satisfactory character. There is the certainty that more movements will be better planned and executed, and that the art of direction of operation of trains will be greatly advanced and the work more safely rendered.

NEW CATALOGUES.

Bulletins G and H from the Pacific Electric & Manufacturing Co., San Francisco, are respectively devoted to oil switches and pole top switches manufactured by the company.

Westinghouse Electric & Manufacturing Company are distributing their Ad. Book No. 10 among interested central stations. This contains twelve pieces of newspaper copy advertising central station power and should form a valuable auxiliary to electrical publicity.

Reynolds Electric Flash Manufacturing Co., Chicago, Ill., have issued a series of seven bulletins and price lists telling of their products. These include flashers, whirlers, script writing flashers, revolvers, combination flashers, automatic time switches and flag flashers. They have also issued a bulletin on the Oliver Roto.

In these days of automatic railway signals the thorough testing of such signals is absolutely necessary. For this purpose the General Electric Company has designed a volt-ammeter which it describes in Bulletin No. 4714, recently issued. This instrument is arranged for four capacities or combinations, so that two voltage ranges and two current ranges, or three current ranges or one voltage range can be obtained. These instruments are contained in polished mahogany cases, and are portable. The bulletin contains reproductions of the scales in actual size.

LARGE RESERVE STEAM STATION.

Profiting by the misfortune of the city of Winnipeg, which has been practically in darkness for the last few months, due to the shutdown of a water power station, the public utility companies of Pacific Coast cities have been seriously considering the installation of reserve steam plants in order to protect their constituents from a possibility of such troubles as at Winnipeg. Although the management of all the companies has been giving this serious thought, the first to take definite action has been the British Columbia Electric Railway Company, Ltd. This concern owns and operates the railway systems of Victoria, New Westminster and Vancouver and is installing several interurban lines connecting all of the rich and fertile valleys around Vancouver. Its endeavor has been to give the public satisfactory service. With this in mind, as soon as the need of an up-to-date steam generating station was brought to their attention by the disaster in Winnipeg, the directors immediately took steps to protect the interests of the public in Vancouver and vicinity by the installation of an up-to-date steam generating station which will serve as an auxiliary in case of breakdown on any part of the water power system. This station with the realty holdings, dredging, etc., will represent an outlay of about $500,000.

The British Columbia Electric Railway Company recently awarded contract to the Allis-Chalmers-Bullock Company for two 2,000 kilowatt Allis-Chalmers steam turbines, with a stipulation in the contract that delivery should be made at the earliest possible date, subject to bonus and penalty. At the same time the general contract was awarded for the construction of the steam station to the well-known engineering concern of Charles C. Moore & Co., placing the contract through the Seattle office. This contract is one of the largest for machinery which has ever been placed in the Northwest, and includes Babcock & Wilcox boilers, Babcock & Wilcox chain grate stokers, Wheeler condensers, all auxiliaries, piping, foundations, flues and a reinforced concrete chimney 11 feet in diameter by 240 feet high.

The installation will be the most modern practice in engineering in connection with auxiliary steam stations, and Mr. C. R. Weymouth, the head of the engineering department of Charles C. Moore & Co., engineers, is now in the East placing orders for the machinery.

Charles C. Moore & Co.'s contract involves heavy bonus and forfeiture clause regulating the time of completion, and the installation of this plant will be made in record-breaking time. An endeavor will be made by the concern to have the 6,000 horsepower station completed and operating by May 1st. Great interest is already manifested by the engineering public as to when this plant will be ready for operation. The early date specified in the contract could only be met by a concern having the able organization possessed by Charles C. Moore & Co.

TRADE NOTES.

The General Electric Company is to be complimented upon the high class of electrically heated household appliances which were exhibited at the Alaska-Yukon-Pacific Exposition recently held in Seattle. The quality and appearance of the apparatus displayed was evidenced by the fact that they were presented with two separate and distinct grand prizes for this class of material. A misunderstanding has been prevalent as to what these two prizes included, and as a matter of information we might say that one of them applied to "cooking devices," such as the cereal cookers, broilers, ovens, toasters, percolators, etc., and the other one included "heating devices," such as the flat iron, tubular air heaters, luminous radiators, etc.

There is but one conclusion to be drawn from the above facts; that is that the General Electric Company were honored with the highest possible tribute to their product.

The Merced Falls Gas & Electric Company has purchased from the General Electric Company three O. C. 60, 150-kw., 11,000-volt primary, 2200-volt secondary, oil-cooled transformers. Also, one 2200-volt, 3-phase, 60-cycle 100-ampere, 38-kw., type 1, R. T. automatic feeder regulator and a 3-panel switchboards.

The Central Oakland Light and Power Company, A. M. Hunt, president, has completed the structural steel work on its three-story electric power station at First and Alice streets, in Oakland, where it has a ground area of 30,000 square feet. The boilers will be installed on the ground floor and the steam turbine generating sets on the second floor. The initial equipment includes two 2000 kw. Westinghouse-Parsons turbo-generators. The laying of underground conduits will be commenced during the coming week.

The Pelton Water Wheel Company's San Francisco factory is working overtime on large turbine wheels and it is expected that a night shift will soon be put on. Pelton-Francis turbines are being constructed to replace the original water wheels at the Washington Water Power Company's plant in Spokane, Wash. Additional turbine wheels are being constructed for increasing the equipment of the Pacific Light & Power Co.'s transmission plant on the Kern River. The effective head is 257 feet.

Due to fast increasing business, both the Chicago and Baltimore branches of the H. W. Johns-Manville Company have outgrown their present quarters, and about March 1st, both will move to new locations, with more room. The Chicago branch, now on Randolph street, will move to the four-story and basement building at Nos. 27-29 Michigan avenue, located in the block between South Water and River streets. With 32,500 square feet of floor space, offices, store and stock rooms will all be under one roof, with ample room for all. A full stock of J-M products will be carried, thus assuring prompt shipments. The Baltimore office, store, and warehouse will be located at No. 30 Light street. Here the company will have considerably more room than before, and will keep on hand a large stock of J-M products and will be in much better position than ever to give all orders prompt attention.

An impulse water wheel contract recently awarded the Pelton Water Wheel Company's San Francisco works consists of a 700 hp. single overhung Pelton impulse wheel, direct connected to a Westinghouse alternator. This apparatus is intended for the Hilo Electric Light Company, Hilo, Hawaii, and supplements their existing hydro-electric equipment. There is an effective head of 418 feet, giving a speed of 400 r.p.m. A special automatic nozzle is being furnished, the direct actuation of the nozzle orifice being obtained by means of a Pelton oil-pressure speed-governor. The question of water economy is of the utmost importance in this plant and as the load is extremely variable, it follows that unless the water is throttled at the impulse wheel, a considerable amount would go to waste. By the installation of the automatic nozzle, the highest possible degree of water economy will be obtained, irrespective of load changes. This will result in a greater peak output. The plant will supply current for various pumping stations on plantations adjacent to Hilo. Automatic adjustment of the nozzle mechanism for impulse units is steadily increasing in favor with engineers who are confronted with the porblem of maximum water economy. Not only are the nozzles of hydro-electric Pelton impulse units directly actuated by the governor, but Pelton wheels for driving air compressor are also equipped with this attachment. Speed regulation and efficiency is not affected by the device, neither is there any danger of water hammer, even should the entire load be instantly dropped from the wheel, because these important features have been taken care of in the peculiar design of the Pelton automatic nozzle.

NEWS NOTES

FINANCIAL.

HOOD RIVER, ORE.—Municipal bonds in the sum of $90,000 have been sold to John Nuveen & Co., a Chicago bond house, for $90,026, the money to be used in constructing the city's proposed new water system.

DRAIN, ORE.—The City Council has passed an ordinance to acquire or build a water system for the city and to issue $5,000 in bonds therefor, payable in 30 years, with interest at 5½ per cent; also an ordinance was passed to create a sewerage system, and the issue of $5,000 in bonds for that purpose was authorized.

LOS ANGELES, CAL.—Bonds to the amount of $300,000 of the Ontario and San Antonio Heights Railroad Company have been placed on the market by the Pacific Light and Power Company, which controls the road. It has just been completed and will form a link in the Huntington system of interurban trolleys, extending from Los Angeles through Southern California. The company will connect the present line at Upland, Ontario and San Antonio with the road now operated by the Pacific Electric at Pomona. This line will be in operation before June 1st. Following this the Pacific Electric Covina line from Los Angeles will be extended to Pomona, and this will be followed again by an extension to San Bernardino if rights of way can be secured.

INCORPORATIONS.

PORTLAND, ORE.—The Oregon Water Power and Land Company, with a capital stock of $100,000, has been incorporated by Charles Stout, G. A. Johnson and J. R. Hollister.

LOS ANGELES, CAL.—Mont-Antonio Water Company, with a capital stock of $75,000, has been incorporated by Alex Kirkpatrick, F. M. and Lydia A. Dyke, Ira J. and Ella Cree.

CENTERVILLE, WASH.—The Centerville Telephone Company of Centerville, Wash., with a capital stock of $5,000, has been incorporated by Henry Garnor, Theodore Jackel and Henry Jackel.

SAN FRANCISCO, CAL.—Tuolumne River Power and Irrigation Company, with a capital stock of $50,000, was incorporated by D. A. Jones, G. W. Barnett, C. W. Terry, T. F. McGovern and C. H. Segerstrom.

SPOKANE, WASH.—The Commonwealth Power and Water Company of Spokane, with capital stock of $5,000,000, has been incorporated by J. E. Burns, E. F. Waggoner, F. W. Dewart, L. H. Brown and Carl Ultes.

TRANSMISSION.

HUSUM, WASH.—The Husum Power Company will enlarge its plant soon.

NORTH YAKIMA, WASH.—E. T. Stone has filed on 5,000 cubic feet per second of water in the Yakima river for power and manufacturing purposes.

SEATTLE, WASH. — Thomas-Jacobsen, Inc., capital $1,000,000; B. Thomas, John P. Jacobsen and S. S. Langland, 534 New York Block, will develop water power in the State.

TUCSON, ARIZ.—The Great Western Power Company has presented to Tucson City Council details of a project for developing about 250 horsepower in Sabino Canon in Catalina Mountains, 18 miles from here, where the company proposes to spend $1,500,000 in necessary storage and power works.

SPOKANE, WASH.—The Washington Water Power Company is considering plans for developing 40,000 horsepower by sinking a shaft from the crest of the upper falls and tunneling to the present plant or by the construction of a dam and pipe line. Either plan will cost about $1,000,000.

CECILO, ORE.—Portland capitalists have recently purchased 80 acres from I. H. Taffo and propose to build a town. Portlanders are J. W. Grussi, O. L. Daggett, A. L. Holst, Charles M. Zadow, Frank A. Jeffrey and Frank U. Jones, and compose the Celilo Milling and Power Company. The contract stipulates that the power company is to erect a power plant on the premises, and while it is not stated for what the plant will be used, it is supposed that electric power will be generated here for the use of railroads, flour mills, etc.

SEATTLE, WASH.—As an integral part of the merger of eight separate electric power, railroad, light and irrigation companies in Central and Western Washington, covering more than 50 per cent of the available hydro-electric power resources of the State subject to private development, Robert E. Strahorn has closed the deal in this city for the purchase of the water rights and surveys of the Columbia Development Company for $100,000. Involved in the deal is the construction of a hydro-electric power plant, with a rated capacity, after full development, of more than 60,000 horsepower.

FRESNO, CAL.—The work now being done by the San Joaquin Light and Power Company in the hills about North Fork and Crane Valley will be practically finished by August 1st. The dam at Crane Valley is to be completed about that date, and it is expected that all the rest of the work will be finished before the dam is in. The wagon road from North Fork to power house No. 1 is on an 8 per cent grade and covers the same ground formerly traversed by a road which was a'most bad for a pack train. Motors for the new cars which the traction company will have here about the first of the company month, arrived last week. There are 20 of these motors, with controllers, etc. These ten new cars are now in the paint shop, and it is not definitely known just when they will be shipped. Contracts have been signed by the traction company for a new 400 kilowatt motor generator, to be used in the operation of the street car system. It will cost $15,000 and will generate enough power to drive all of the present cars. It will be here in about two months, and will be used as an auxiliary to the local plant to forestall danger of complete breakdowns. Poles are now up on the new Coalinga-Lemoore power line except over a space of about ten miles southwest of Huron. It is expected that poles will be set in the next few days.

TRANSPORTATION.

KENT, WASH.—The Valley Railway and Power Company has been granted a 35-year franchise for a street railway system here.

ABERDEEN, WASH.—C. C. Quackenbush of this city is promoting a project of building an interurban from this place to Seattle, a distance of 87 miles.

BUTTE, MONT.—It is reported that the Montana Rapid Transit Company has been financed and will build its proposed line between Helena and this place.

SALT LAKE CITY, UTAH.—A petition has been submitted by E. O. Howard for a franchise to construct tracks over certain streets in the city for an interurban road to be built from Salt Lake to Provo.

BELLINGHAM, WASH.—This place has completed the $400,000 guarantee fund to insure the building of an interurban electric line between this and Skagit county cities. Stone & Webster will construct the line.

SAN FRANCISCO, CAL.—A resolution has been introduced calling on the Board of Public Works to have prepared by the Bureau of Engineering plans and estimates for reconstructing and extending the Geary street railway.

SEATTLE, WASH.—A franchise for the privilege of operating a railway service from Kent to Renton will be placed before the City Council by the Valley Railway and Power Company, of which H. B. Madison of Kent is the president.

EL PASO, TEXAS.—The El Paso and El Paso Valley line will not have an interurban electric line this spring. The reason of this action is that some of the benefactors failed to join in the co-operative movement to furnish rapid transit to El Paso Valley.

SAN FRANCISCO, CAL.—The Vallejo and Northern Railroad Company has been granted a 50-year franchise. The new franchise covers the same privileges granted the company two years ago, and provides that the franchise work is to be commenced within six months and the road completed within three years.

SACRAMENTO, CAL.—At the Trustee's meeting all the requests of the Judicial Committee in the matter of the application of the Sacramento Electric, Gas and Railway Company, for a franchise on Y street from Tenth to the Riverside road, were complied with and the franchise was ordered advertised.

FRESNO, CAL.—Manager A. G. Wishon of the Fresno Traction Company states that work on double-tracking of the system in this city has gone no further recently than the distribution of rails along rights of way. Work on the Coalinga-Lemoore power line has progressed as far as the placing of the cross-arms.

POMONA, CAL.—The Pacific Electric Railway will construct a single track line along West Second street within 30 days. The company has asked for a new franchise down Garey to Franklin avenue and for a franchise on Fifth avenue from Garey eastward to the city limits. These latter tracks will be finished in six months.

ILLUMINATION.

MEXICO CITY, MEX.—Don Pedro Flores of Tasco, in the State of Guerrero, has ordered from the Allis-Chalmers Company a complete electric lighting plant, which will be installed at Tasco.

COTTAGE GROVE, ORE.—The Cottage Grove Light Company, having been granted a five-year contract for light in the city, will at once begin the improvement of its plant and will install a 600 horsepower engine.

TACOMA, WASH.—The commissioner of Public Works is authorized to enter into a contract with the United States Incandescent Lamp Company for the purchase and delivery of incandescent electric lamps to the value of $25,000.

SPOKANE, WASH.—H. L. Moody, president of the Spokane Railway and Power Company, states that the company has selected a site at Le Pray bridge, on the Spokane river, and is preparing to spend $1,500,000 on an electric lighting plant there.

COLUSA, CAL.—The Pacific Gas and Electric Company is contemplating improvements for the town of Colusa. They are at present remodeling their plant at Second and Main streets, where they will put in new boilers, two new pumps, two purifiers and lamp black separators.

GEORGETOWN, WASH.—The City Council has passed an ordinance authorizing Robert M. Jones to erect gas, electric light and power works, to lay pipes for the distribution of heating and illuminating gas and to construct apparatus for an underground electrical system in Georgetown.

POMONA, CAL.—The Southern California Edison Company is planning large extensions to its gas mains and equipment for service here. Lately an active business has been done in laying service mains and lines to new subdivisions about the city. In the southern part of the valley much extension work is being done along the electric lines, and many new motors have been installed for the running of the pumping plants.

SEATTLE, WASH.—The Othello Improvement Company has awarded a contract to the Northwest Bridge Company for the construction at Othello of a power house, to furnish electric light and power for the city, at a cost of $17,000. Arrangements have also been made with the same company for installing a street lighting system and for laying 116,000 square feet of cement walks, and also for the erection of a factory, details of which are to be agreed upon later.

SUISUN, CAL.—Benj. F. Rush, Senator from Solano and Napa counties, has started a crusade against the electric light companies operating in the various cities and towns throughout his district. Senator Rush has announced that if the present corporation laws of the State are not adequate in bringing the public concerns to time, he will introduce at the next session of the Legislature such bills as will permit municipalities to so control the fixing of light, power and other rates as to prevent the extorting of unreasonable tolls by the corporations.

TELEPHONE AND TELEGRAPH.

AUBURN, CAL.—Manager Bryson has been authorized to build a telephone line from Alta to the Rawhide mine.

HAINES, ALASKA.—The Arctic Development Company was granted a franchise to construct and operate a telephone system here.

COUPEVILLE, WASH.—The Utsalady Telephone Association was recently granted a franchise for a telephone line along certain roads.

NORTH YAKIMA, WASH.—All bids for constructing the west side drain were rejected as being too high, $33,000 being the amount available for this purpose.

SPOKANE, WASH.—Local and Long Distance Telephone Company will extend the lines to the Coast this year, announces Manager L. V. Gray, Lindelle Block.

BAKERSFIELD, CAL.—The Producers' Transportation Company has been granted permission to construct private telephone and telegraph lines along their pipe line between here and McKittrick and Midway.

OAKLAND, CAL.—The redistricting and renumbering of telephones in the newly annexed districts of Oakland has been completed by the Pacific Telephone and Telegraph Company, and all telephone subscribers in the district east of Jackson street are listed on the newly completed Elmhurst exchange on East Fourteenth street in the Fitchburg district. The old arrangement whereby telephones as far out as Elmhurst were listed on the Meritt exchange has been done away with and that exchange will extend only as far east as Jackson street. The fight between the telephone company and residents of Elmhurst over telephone rates may have its solution in the threat of several business men of that district to take the matter before the City Council. As Elmhurst is a part of the city now, it is contended that residents there are entitled to the same service at the same price as other parts of the city.